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AFRICA AND THE GLOBAL MODELLING SYSTEMS: SOME ISSUES

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INTRODUCTION

1. This paper provides a brief overview of ongoing work in global modelling activity at several United Nations agencies, other international organizations and academic institutions. The main thrust of the paper is an analysis of the treatment of Africa in these models and the present and future role of ECA in these global modelling exercises.

2. The paper also reviews ECA's ongoing activities in the construction and use of econometric models. Specific proposals for future work in this area are outlined. These proposals are designed to strengthen the links among African countries, ECA and the organizations that are involved in the construction of global models. The thrust of the proposals is multi-dimensional. Firstly, the proposals aim at ensuring that Africa is adequately represented in these models and secondly, to ensure that Africa can effectively utilize the results of these models to generate scenarios for strategic analysis of Africa's interdependence with the global economy.

I. OVERVIEW OF GLOBAL MODELLING ACTIVITIES

3. Global modelling exercises are a key feature of the work of several international organizations. The purpose of these models, in the most general terms, is to identify and qualify the links between individual countries and regions. These links are usually expressed in terms of trade relations and financial flows. The precise objective of individual models usually depend on the overall objectives of the modelling agency.

4. For example, within the United Nations secretariat, global models were used extensively by DIESA, UNCTAD and UNIDO to identify and quantify feasible targets for the United Nations Development Decades. Similar exercises in the 197os addressed issues related to the establishment of a New International Economic Order.

5. UNITAR, ILO, CEPAL and UNESCO collaborated on modelling exercises with the underlying theme of the basic needs approach to economic development. The basic needs theme also guided the modelling efforts of the World Bank during the 1970s. However, the Bank also shifted its focus as policy its objectives changed over the years. This earlier emphasis on the basic needs theme was replaced by concerns about the external constraints to growth of developing countries. Two-gap growth models were developed for these countries emphasizing the foreign-exchange constraint to growth under different scenarios regarding aid and trade policies of developed countries. 1/

1/ S.P. Gupta and J. Waelbroek. "World Bank and Global Modelling Research". In UNIDO Proceedings of the Seventh International Conference on Input-Output Techniques. (United Nations publication, Sales No. E.84.II.B.9).

6. Academic institutions have also been involved in the global modelling activities largely oriented towards advances in the theoretical field of global modelling and the development of sophisticated computer software for the solution of these large-scale models. 2/

A. The global models of the UN Secretariat

7. The UN Department of International Economic and Social Affairs (DIESA) has concurrently worked on three long-term models known as the Global Econometric Model (GEM), the Global Input-Output Model (GIOM) and DYNAMICO. The general purpose of these modelling efforts is partly to give long-term projections of the world economy and to measure qualitatively the possible effects of international policies for world economic growth.

8. The GEM consists of about 13 individual two-gap country or regional models which are linked by a world trade matrix. The model has been used to set growth targets for the UN International Development Strategies for the 1970s and 1980s. In more recent years the model has been used to analyse socio-economic issues such as (a) capital requirements of developing countries, (b) expenditure levels needed for the attainment of literacy and health targets and (c) possible changes in the distribution of income.

9. The GIOM model is an input-output based model which partitions the world in 15 economic regions each with a region specific sub-model. Broadly, the model consists of three systems of relationships:

- The regional sub-models which give gross output and factor requirements for given levels of final demand;
- The dynamic system which generates growth paths through a dynamically recursive procedure;
- The linking system which uses trade and other payment flows to integrate regional economies into a simple world system.

B. The global model of UNCTAD

10. The UNCTAD Secretariat has developed a system for Global Modelling Analysis (SIGMA). The system consists of 15 regional sub-models which all inter linked via models of international trade, prices and financial flows. The model results are used to give the outlook of the world economy published annually in the Trade Development Report.

2/ These are project LINK based at the University of Pennsylvania in the United States and the Future of Global Interdependence (FUGI) global macroeconomic model at the Centre for Global Modelling, Soka University, Japan.

C. The UNCTAD-UNIDO joint global model

11. The UNCTAD and UNIDO secretariats have collaborated on a joint modelling project known as UNITAD. The UNITAD consists of 11 regional models (5 for the developed and 6 for the developing regions) interlinked through seven trade matrices and interregional financial flows. As such the model can be used for simulating the impact of patterns of world economic structures of trade on industrialisation and other aspects of development of any of the developing regions and vice versa. Each regional model has an input-output table, a technology mix, final demand variables, trade relationships and employment balances.

D. The Global Modes of the World Bank

12. The World Bank Global Modelling exercise has passed through several stages. In the early 197os the Bank had a two-gap SIMLINK model. This was followed by a World Development Report (WDR) model which consisted of a linked dynamic linear programming model with a system of capital, debt and lilateral trade matrix. The need to better analyse effects of international markets led to the Bank's development of a general equilibrum type of model in which different markets are analysed simulteneously.

E. The Tsukuba-FAIS World Econometric Model

13. The Tsukuba-FAIS World Econometric Model (T-FAIS VI) is based in Japan at the University of Tsukuba. The model consists of 24 countries and regions with 8 major industrial countries and one regin for the developed world; 11 major countries and 2 regions for the developing world and two socialist regions. The country and regional models are linked together by two types of matrices one for primary commodities and one for manufacturing trade flows. 3/

F. The FUGI Model

14. The Global Modelling Center of the Institute of Applied Economic Research, Soka University, Japan developed a world model known as the FUGI Global Macro-economic model. The FUGI model has 140 country and regional submodels for developed market economies, developing market economies and centrally planned economies. Each national and regional model has interlinkages of four subsystems namely (a) environment, (b) development, (c) peace and security and (d) human rights. The interlinkages of the models among each other is achieved through both direct and indirect networks of trade, capital flows, exchange rates, export and import prices, interest rates, etc.

3/ See Shishido et al (1981).

G. The Link System

15. The Link System which is based at the University of Pennyslvania is one of the unique efforts to try to link up individual models into a single system. Broadly, the system allows for various model results that are generated at the country level to be fed into the system to generate overall forecasts and projections. In cases where national models do not yet exist or are not linked to the system, there are models for countries and groupsof countries that are maintained at the University itself. Because of the system of linking, there are a number of subgrouping of countries. In general the model generates results for groups of countries such as North Africa, Developed East EEC and Rest of Industrialised countries, OPEC, Africa, Asia, non-oil Middle East, Western Hemisphere, and Centrally Planned Economies (without China).

II. THE TREATMENT OF AFRICA IN GLOBAL MODELS

16. In analysing the treatment of Africa in the existing global models it is important to examine three aspects namely (a) the coverage of the region in terms of countries included in the global models, (b) the nature of specification of models for the African countries or regions and (c) the policy or scenario analyses and their relevance to the African region. Admitedly although the different global models have different emphasis as regards these aspects in the context of Africa, the outline given is based on a general assessment of all the models. Indeed, it is intended mainly to highlight the policy issues that African planners should address as regards a more effective integration of the African economies in the different global models.

A. Coverage of the African region in Global World Models

17. Broadly most World Economic Models have had a fairly uniform view of the major subdivisions of the world economy. In most models the pattern has followed that suggested by Prof. L. Klein:

(i) The first World or Developed Market Economies (OECD) South Africa

(ii) The Second World or Centrally Planned Economies (CMEA, China, USSR, North Korea, etc.)

(iii) The Third World or the Developing (or even the less developed) countries.

18. Most models try a meaningful disaggregation of the three broad categorization of the world economic groupings. Since developing Africa is always in the category of the third world, it is pertinent to focus on how this third category is usually disaggregated.

19. In the United Nations GIOM model the relevant categories include. 4/

Latin America (medium income)
Latin America (low income)

4/ See Antoio M. Costa, United Nations Global Modelling: experimental projections on the basis of alternative procedures in Proceeding of the seventh International Conference on Input-Output Techniques.

Asia (low income)
Middle East Africa (oil producers)
Africa (arid)
Africa (tropical)
Africa (medium income).

20. In the UNITAD model the categories adopted for developing countries include:

- Tropical Africa (subdivided in four subgroups: Nigeria and Gabon, countries with GDP per capita of below US@200 and those with GDP from US$200 to 500 and the countries of Djibouti, Namibia and Reounian

- North Africa and the Near East
- Asia I (Afghanistan, Nepal & Buthan plus all Asia less less low income countries

- Asia II (Indonesia, Phillipines, etc.)
- Latin America I (per capita GDP between US$200 and US$500)
- Latin America II (same as Latin America I but a different set of countries, mainly islands)
- Latin America III (GDP per capita above US$500)
- Latin America IV (same as III but mainly islands)
- Latin America V (GDP less than US$200).

21. In the FUGI Model the subgroups for the developing countries are:

- Oil exporting countries
- OPEC in Middle East
- Non-oil exporting countries
- NICs
    - Asian NICs
    - Latin American NICs
- Asia and Pacific
    - East Asia
    - Asean
    - Other Asian and Pacific
- Middle East
- Africa
- Latin America and Carribean

22. In the LINK System which tries to link up individual country models, about ten African country individual models are included in the system (Algeria, Egypt, Ethiopia, Gabon, Kenya, Libya, Morocco, Nigeria, Sudan and Tunisia). In addition, two groups of models cover the rest of Africa namely African least developed countries and other African countries.

23. From the above brief survey, the obvious trend in the coverage of Africa can be discerned. Firstly, most of the groups identified for Africa are based on income levels. Secondly, there is a tendency to amalgamate North Africa with the Middle East. Thirdly, many models tend to lump together countries that are fairly heteregeneous in economic structures mainly as a fill-in for lack of more viable subregional groupings. Overall, it would seem that the coverage of African countries in terms of more homogeneous subgroups is still lacking in most of the global models.

B. The specification of models for African countries

24. Although the specification of global models varies widely depending on the orientation of the model and the basic technical approach (i.e. econometric, input-output, or dynamised linear programming), there is a general trend for most global models to adopt relatively very simple pro-type of models for African countries. This general trend is a result of a number of factors to which Africa must pay particular attention if it is to ensure that its economies are adequately and effectively incorporated in the different world models.

25. The first factor is that many global model builders are not usually very acquainted with the structural problems of the African economies. As such, it is often not easy to make model specifications that reflect the very structures of the economies of Africa. For example many supply specifications (e.g. Harrold-Domar production functions) that are used in the models tend to be far removed from the African economic realities. To rectify this situation, it is necessary that African countries and nationals as well as regional research institutions undertake more extensive work in specifying models that are more suited to their realities. Over time such specifications would become increasingly adopted by those involved in global modelling.

26. A second important factor relates to the problem of data. Even in cases where global model builders have the intentions to elaborate good models that suit the African economies, they often confront the veritable constraint of lack of data with which to generate the needed model parameters. This problem often leads to adopting simplified functions and simplifying assumptions including the use of proxy-parameters that may be widely different from those that should be applied to the African models.

27. The third problem derives from the shortage of data and the very large number of African economies that have often widely differing economic characteristics. This often leads to a short-cut method of elaborating models for groups of countries that have very little in common. Usually, the model builders base such groupings on income levels which in most cases do not reflect the structural characteristics of the economies. African planners would do well to try to influence the groupings towards those that are more reflective of the African economic structures. Through strong recommendations and, of course, more participation in the global modelling efforts, Africa could ensure that the relevant groupings are used in the models. Such groupings could be based on subregional entities that have significant structural homogeneity such as SADCC, ECCAS, PTA, ECOWAS, CILSS, North AFrica, etc.

C. Policy or scenario analysis in global models

28. For any region to benefit from the policy analyses of the global models, it is vital that the region's basic concern as regards its economic relations with the world can be reflected in the different scenarios. For Africa which is highly dependent on exogeneous factors in the international economic environment, this consideration is of crucial importance.

29. While different global models have different orientations for policy analysis (either because of the model design and specification or because of special concerns), there is a wide spread tendency for the global models to focus on two broad policy aspects namely (i) the policy options and implications in the industrialised countries and (ii) the "locomotive" effect between the developed and developing countries.

30. For example, the 1986 LINK simulations there were policy analyses dealing with (i) additional oil price increase of 25 per cent, (ii) further depreciation of the US dollar by 20 per cent and (iii) policy co-ordination among the major industrialized countries. Similarly, recent simulations of the Tsukuba-FAIS model have dealt with scenarios of policy co-ordination (e.g. industrialized countries). The latest version of the FUGI global model type V has focussed on scenarios like international co-operation with particular reference to the Asian and Pacific economies.

31. For the policy analysis for the developing regions, all global models put emphasis on the links between the developed and developing countries - links which enable the transmission effect of growth. Often, such transmission is modelled on the basis of growth elasticities which relate the average growth rate of developing regions to that of the industrial countries.

32. However, in the African context, it must be stressed that links that relate Africa's growth to the growth of industrial countries do miss out other important aspects such as primary commodity prices, resource flows, environmental conditions etc. It, therefore, becomes very important for African countries to more concretely define and propose more appropriate mechanisms through which the African economies can be linked to the global framework so as to enable the analysis of policies and implications that are relevant for Africa in the overall global framework.

III. CONCLUSIONS AND RECOMMENDATIONS

33. Given the interdependence of the world economies, it is useful to have global models which, through analyses of different scenario, can generate insightful policy options and their implication. In many ways, the existing global models in the UN System and in academic institutions serve as a very important base for the purpose.

34. Africa can benefit from such global modelling efforts in terms of having relevant analyses on likely trends in the international environment (e.g. commodity prices, world inflation, resource flows, technological changes, interest rate movement, overall world growth etc.). With such globally analysed scenarios, Africa can more effectively evolve strategies for short-term adjustments as well as long-term changes in line with the forecast or projected international economic environment.

35. However, for Africa to fully benefit from the global efforts there is need for:

(a) better coverage of the African region in terms of the number of countries included in the models or a more appropriate grouping of the African countries preferably along lines of homogeneous subregions;

(b) better specification of the submodels relating to Africa so as to better capture the structure of the different African economies and groupings as well as the constraints to growth and development;

(c) better policy focus in the global models on the issues that influence the dynamics of growth and development of the African economies.

36. For the above conditions to be fulfilled, there is need for actions to be undertaken by both the African region and the various international agencies that are involved in global modelling. It is within this perspective that the recommendations that follow below are made.

37. The first important action that African must embark on is the development of an agenda for modelling (either for short-term forecasting or long-term projections). This will have to involve concerted and simultaneous efforts at the national, sub-regional and regional levels.

38. At the national level, individual countries should strengthen their capabilities in model building and maintenance. This would result in more relevant models and, through experimentation, the definition of better model specification. It should be stressed that some global modelling systems such as the LINK are based mainly on nationally maintained models. African countries should therefore encourage their national research institutions and planning agencies to undertake more work in the field of modelling. In addition, countries could seek the assistance of UN agencies to assist them in model building. The improvement of the data base in the individual African countries is also an important prerequisite to the improvement of Africa's integration in global models.

39. The national efforts will, no doubt, have to be complimented and supported by Africa's subregional and regional organisations. In this respect the following proposals are worthy considerations:

(i) Africa's subregional organisations (e.g. SADCC, ECCAS, ECOWAS, PTA, CILSS, etc.) must start to undertake work in modelling. This could be done in two non-exclusive ways. Firstly, these subregional organizations could support the building of national models within the countries and then proceed to a phase of a SUBREGIONAL LINK System whereby individual country models are interlinked to generate one subregional system. Secondly, the subregional organisations could build up subregional models directly taking into account the specific realities of the subregion as a whole.

(ii) Subregional organisations in Africa should strengthen or establish contacts with the agencies that are involved in global modelling so as to more closely follow their activities and be able to influence the treatment of Africa in general and their subregions in particular in the models. Closer contacts would also enable the more effective utilisation of the policy analysis scenarios of the global models by the African subregions.

(iii) Subregional organisations should embark on mobilising external resources from bilateral and multilateral donors to support their modelling efforts.

40. For the ECA secretariat, the ongoing work on modelling should be strengthened in terms of assisting African countries to establish appropriate models of their respective economies and also to ensure closer collaboration with the organisations involved in global modelling. In this context, the ECA secretariat should be supported in terms of financial assistance and multilateral donors to enable it to effectively undertake the work. The ECA should formulate a project which it can submit to donors for this purpose.

41. At the international level the following actions are needed for a more effective interlinkage in global models of Africa and the other regions of the world.

(i) There should be increased efforts to more adequately treat the African region in the global models in terms of better grouping of African countries, more realistic specification of the African models and more relevant policy and scenario analyses. Wherever praticable the policy options that have particular relevence and import to Africa (e.g. commodity prices, resource flows, debt etc.) should be fully analysed with respect to the African region;

(ii) The results of the different forecasts and projections of the global models should be widely disseminated to African countries for them to draw the maximum benefit in terms of strategic adjustments or anticipation of possible future constraints and their implications.

42. Overall, it is also proposed that an African Conference on Global modelling should be organised to bring together African planners and those involved in global modelling. Under such a conference a dialogue can be established to enable on the one hand the African planners to more fully understand the nature of the ongoing efforts in global modelling and, on the other hand to enable the model builders to better understand the African concerns and needs.